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No. 21

Photo Story Number 21

THE CASE OF THE HUMMING MICE

As cartoons and novels used to picture it, a lady was supposed to be startled, jump up on a chair and scream whenever she spied a mouse. But, that was before woman's lib and science fiction-like mice.

The old story now has a new script. Today, we are all in for a surprise should we come upon a certain set of USDA Forest Service test mice. These mice can hum and buzz like a touch-tone phone.

The sound-producing mice are Forest Service test mammals that have had a tiny radio transmitter surgically implanted into their body cavities. The device broadcasts the humming signal shortly after each mouse dies.

GYPSY MOTH CONTROL

Forest Service Engineer Robert Neely designed the radio telemetry system, which includes this transmitter. Neely is with the Forest Service's gypsy moth research unit at the Forest Insect and Disease Laboratory in Hamden, Conn. The radio and the mice are being studied there as part of the Agency's gypsy moth research program to establish various methods to control the insect pest.

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NORTHEASTERN FOREST EXPERIMENT STATION • UPPER DARBY, PENNSYLVANIA 19082

The white-footed mouse (Peromyscus leucopus [Raf.]) is a predator of the gypsy moth. During the summer, these invertebrate mammals feed on and destroy the insect pest in both its larval and pupal forms. Because of these feeding habits, the mouse can sometimes control insect pest populations by returning small outbreaks of gypsy moths to innocuous levels and by keeping the level low.

In order to increase an ecosystem's capacity to provide for these beneficial mice, scientists need to know more about the life-style of the white-footed mouse. At present, no one knows for sure what regulates white-footed mouse population numbers. But, once mortality factors are numerically established with the help of the radio, it should be possible to manage the environment in which the mice live, in order to increase their possibilities for contact and feeding upon gypsy moths.

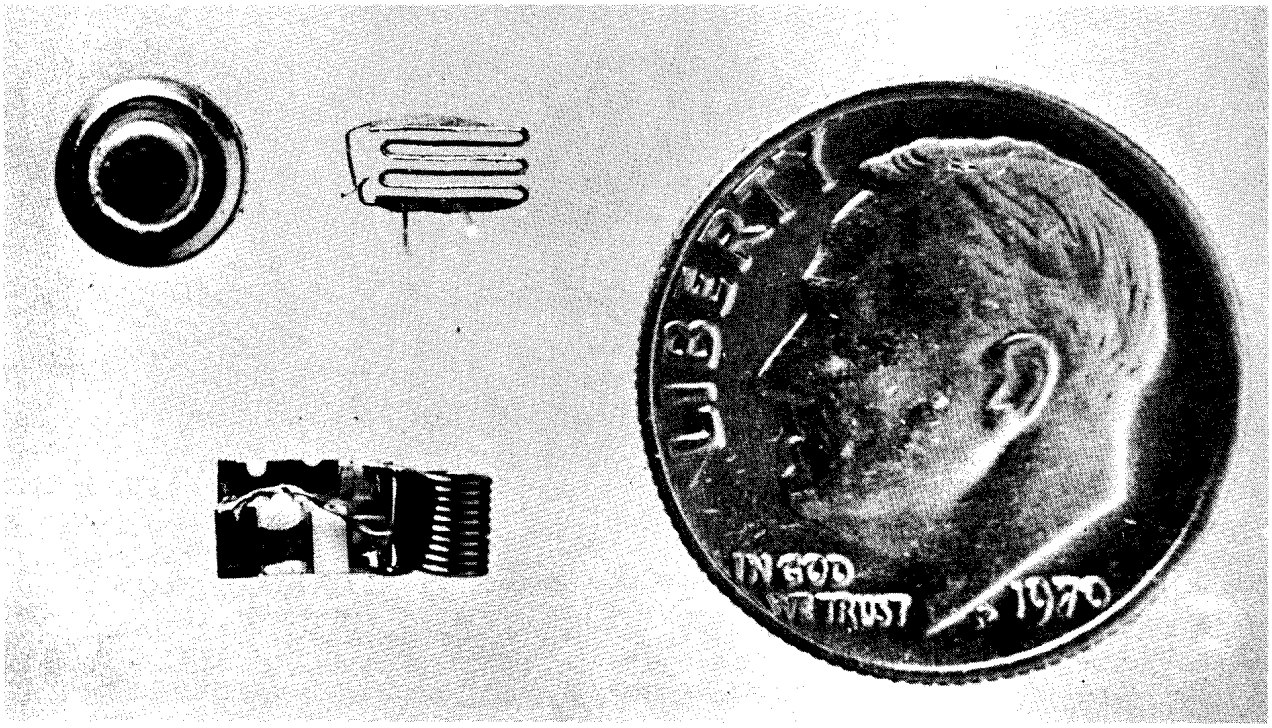
RADIO DEVICE

The newly-developed radio unit is a small device, weighing only .96 grams. Its 3 major components -- a battery energizer, a thermo-switch, and an oscillator -- are small enough to fit side-by-side on the head of a dime. The thermo-switch activates the unit when the mouse's body temperature drops, while the oscillator provides the radio signal. All components are encased in layers of epoxy paraffin and silicone rubber to form a capsule.

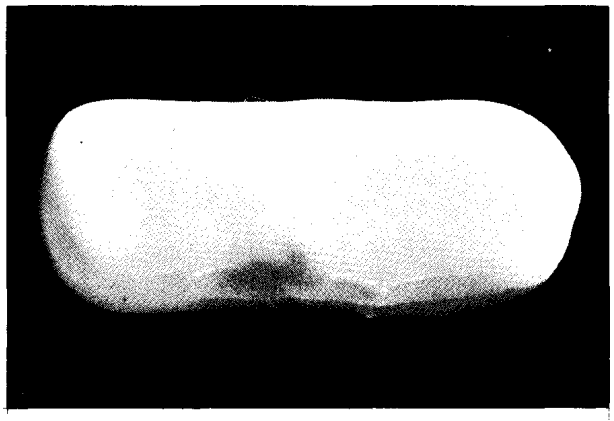
Engineer Neely built the prototype transmitter unit. However, for test purposes, additional units were assembled under a cooperative agreement with the Department of the Navy.

Because of its size, the radio signalling unit is assembled under a microscope. In assembling, an engineer mounts the components on an epoxy wafer, con-

The size of the 3 main components of the radio transmitter are shown in relationship to a dime.



nects and welds their electrical wires together, and then encapsulates the entire system in fast-setting epoxy. After encapsulation, the device is covered with paraffin and silicone rubber to facilitate implanting. Covering with silicone rubber is a procedure used in various biomedical applications. It is beneficial in that it reduces the possibility of irritation to the animal's body tissues. Before surgical implantation, each unit is sterilized in solution and tested.

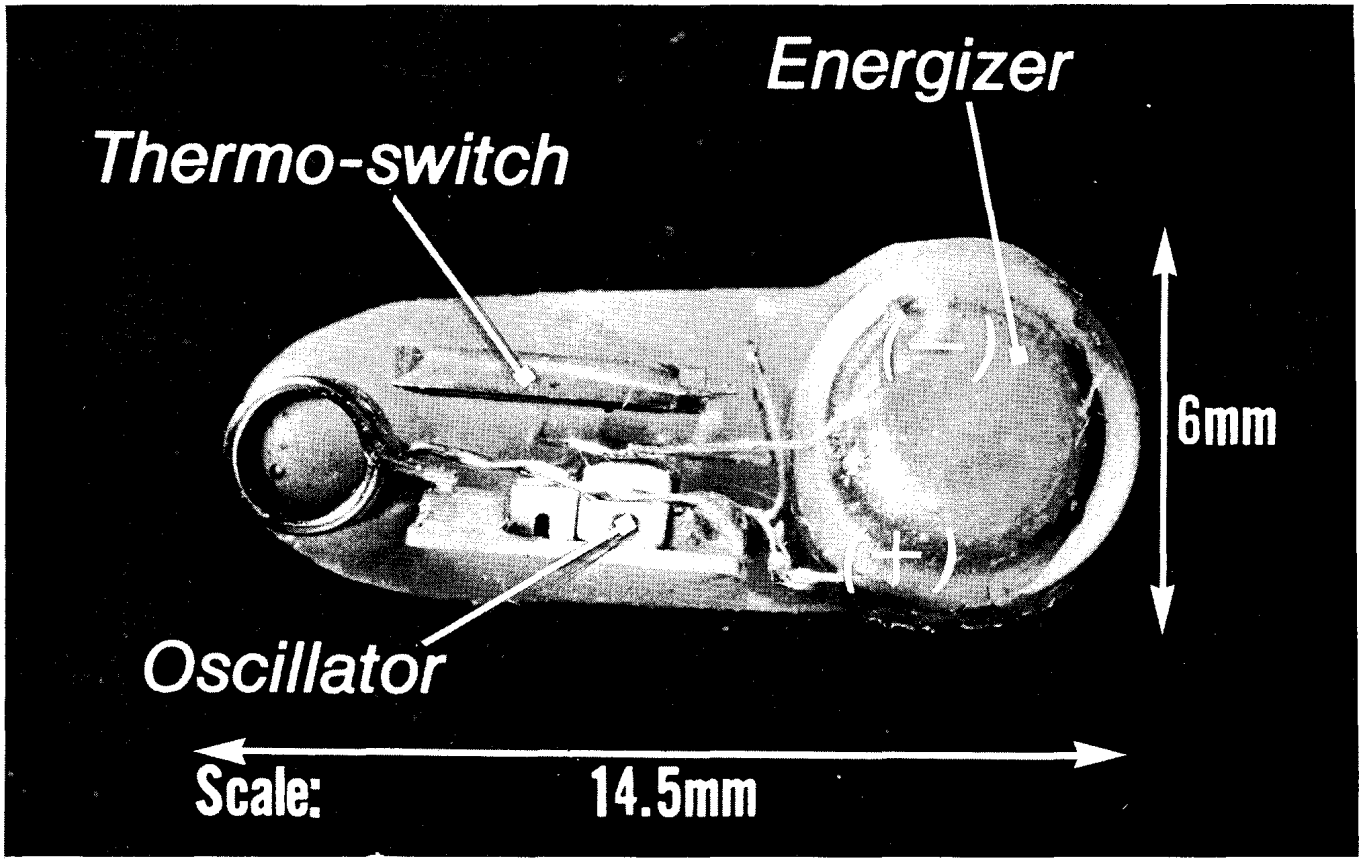


This radio transmitter (many times enlarged) has been encased in silicone rubber. In capsule form, it is ready to be surgically placed inside the body cavity of a mouse.

A veterinarian implants the radio transmitter into mice that were first caught in the wild, then raised in the laboratory. Neither the surgery nor the encapsulated radio has been shown to affect the mouse's normal life processes.

After implantation, mice are released into a test area. When death occurs and a mouse's body temperature falls from the normal 34 degrees centigrade, the temperature-sensitive thermo-switch activates the radio device. The transmitter will continue to send a signal for a distance of 50 yards and for a period of time long enough for researchers to find the animal and recover its remains. An investigation to determine cause of death will begin after recovery of the remains.

An inside view of the radio transmitter, showing the position of its various components.



TELEMETRY SYSTEM

In addition to the radio transmitter, the telemetry system consists of ground antennas, multiplexer stepping switches, stationary receivers, and a portable receiver. The antennas intercept the mouse's signal for the stationary receivers. The multiplexer channels many antenna feed lines to the input of a stationary receiver. Both the receiver and multiplexer are located in a relay station within the area being monitored. From this relay station, the signal can be sent to a convenient distant point.

The antennas are similar to an automobile's antenna. In use, they are set out in a grid pattern with an overlapping coverage area to insure reception of the mouse's signal. The portable receiver is used like a geiger counter by helping to locate the mammal's remains where the signal is strongest.

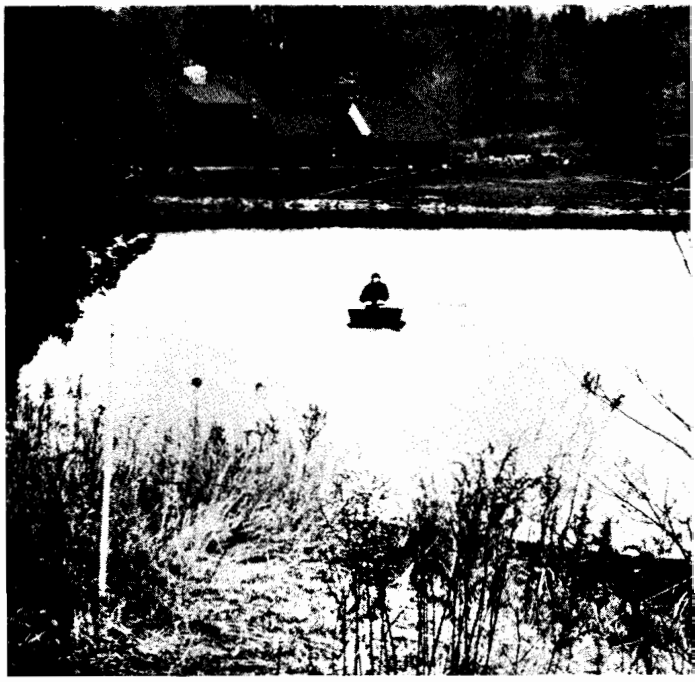
ISLAND TESTING

In a recent pilot test, scientists used a one-half-acre island on a private pond near Guilford, Conn., to release their test animals. The island was surrounded by aluminum flashing to prevent the animals from swimming away from the test site. Otherwise, the island environment was unaltered during testing.

This study helped to determine whether the kinds of places where mice die are accessible, whether cause of death can subsequently be determined, and what problems could arise in the telemetry system during field use.

Signals were successfully picked up by the relay station on the island, amplified, and sent by underwater cable to a receiving station on shore. When a signal was received, scientists rowed to the island with their portable search radio and traced down the dead mouse's remains for analysis. It took only 5 to 10 minutes to locate a dead mouse.

A Forest Service scientist rows to the testing island to answer the signal from a dead radio-implanted mouse. A receiver antenna is shown in the left foreground, while cables leading from the relay station to the shore appear in the center foreground.



SUCCESSFUL SYSTEM

Through this study, Forest Service scientists have established that their radio device is feasible, that it can be implanted, and that it will operate successfully to aid in gathering mouse mortality data. They expect to go on to perfect the instruments and to engage in full-scale testing.

Their first task will be to improve the transmitter, so that it will still be operable up to two years from the date of implantation. In order to do this, they will have to improve the coating that covers the unit, and develop a more reliable battery.

The next task will be to reduce the overall size of the radio transmitter, so that the device can be implanted into juvenile mice. This might be done by developing a new type of thermo-switch and improving the encapsulation materials and technique.